CLAIMS

1. A method of calibrating transmitter units and receiver units at a wireless entity in a multiple-input multiple-output (MIMO) communication system, comprising:

obtaining a plurality of first overall gains for a first receiver unit and a plurality of transmitter units, one first overall gain for each transmitter unit, each first overall gain indicative of a combined response for the first receiver unit and the associated transmitter unit, wherein the first receiver unit is one of a plurality of receiver units;

obtaining a plurality of second overall gains for a first transmitter unit and the plurality of receiver units, one second overall gain for each receiver unit, each second overall gain indicative of a combined response for the first transmitter unit and the associated receiver unit, wherein the first transmitter unit is one of the plurality of transmitter units;

determining a gain of each of the plurality of transmitter units based on the plurality of first overall gains; and

determining a gain of each of the plurality of receiver units based on the plurality of second overall gains.

2. The method of claim 1, wherein the obtaining a plurality of first overall gains for a first receiver unit and a plurality of transmitter units includes,

for each of the plurality of transmitter units,

sending a test signal to the transmitter unit,

receiving the test signal from the first receiver unit, and

determining the first overall gain for the first receiver unit and the transmitter unit based on a ratio of the received test signal to the sent test signal.

3. The method of claim 1, wherein the gain of each transmitter unit is normalized by the gain of the first transmitter unit, and wherein the gain of each receiver unit is normalized by the gain of the first receiver unit.

4. The method of claim 1, further comprising:

deriving at least one correction matrix based on gains of the plurality of transmitter units and gains of the plurality of receiver units, wherein the at least one correction matrix is used to account for responses of the plurality of transmitter units and responses of the plurality of receiver units.

5. The method of claim 1, further comprising:

deriving a first correction matrix based on gains of the plurality of transmitter units, wherein the first correction matrix is used to account for responses of the plurality of transmitter units; and

deriving a second correction matrix based on gains of the plurality of receiver units, wherein the second correction matrix is used to account for responses of the plurality of receiver units.

6. The method of claim 5, wherein the first correction matrix is an inverse of a first diagonal matrix with the gains of the plurality of transmitter units, and wherein the second correction matrix is an inverse of a second diagonal matrix with the gains of the plurality of receiver units.

7. The method of claim 1, further comprising:

deriving a correction matrix based on gains of the plurality of transmitter units and gains of the plurality of receiver units, wherein the correction matrix is applied on a transmit path and is used to account for responses of the plurality of transmitter units and responses of the plurality of receiver units.

8. The method of claim 7, wherein the correction matrix is set to a ratio of a first diagonal matrix with the gains of the plurality of receiver units to a second diagonal matrix with the gains of the plurality of transmitter units.

9. The method of claim 1, further comprising:

deriving a correction matrix based on gains of the plurality of transmitter units and gains of the plurality of receiver units, wherein the correction matrix is applied on a

receive path and is used to account for responses of the plurality of transmitter units and responses of the plurality of receiver units.

10. The method of claim 9, wherein the correction matrix is set to a ratio of a first diagonal matrix with the gains of the plurality of transmitter units to a second diagonal matrix with the gains of the plurality of receiver units.

11. The method of claim 1, wherein the MIMO communication system utilizes orthogonal frequency division multiplexing (OFDM), and wherein the obtaining a plurality of first overall gains, obtaining a plurality of second overall gains, determining a gain of each of the plurality of transmitter units, and determining a gain of each of the plurality of receiver units are performed for a plurality of subbands.

12. The method of claim 1, wherein gains of the plurality of transmitter units and gains of the plurality of receiver units are determined for a plurality of operating points.

13. The method of claim 12, wherein each operating point corresponds to a different gain setting or a different temperature.

14. An apparatus in a multiple-input multiple-output (MIMO) communication system, comprising:

a plurality of transmitter units operative to process a plurality of baseband signals for transmission from a plurality of antennas;

a plurality of receiver units operative to process a plurality of received signals from the plurality of antennas; and

a processor operative to

obtain a plurality of first overall gains for a first receiver unit and the plurality of transmitter units, one first overall gain for each transmitter unit, each first overall gain indicative of a combined response for the first receiver unit and the associated transmitter unit, wherein the first receiver unit is one of the plurality of receiver units,

obtain a plurality of second overall gains for a first transmitter unit and the plurality of receiver units, one second overall gain for each receiver unit, each second overall gain indicative of a combined response for the first transmitter unit and the associated receiver unit, wherein the first transmitter unit is one of the plurality of transmitter units,

determine a gain of each of the plurality of transmitter units based on the plurality of first overall gains, and

determine a gain of each of the plurality of receiver units based on the plurality of second overall gains.

15. The apparatus of claim 14, wherein the processor is further operative to

derive a first correction matrix based on gains of the plurality of transmitter units, wherein the first correction matrix is used to account for responses of the plurality of transmitter units, and

derive a second correction matrix based on gains of the plurality of receiver units, wherein the second correction matrix is used to account for responses of the plurality of receiver units.

16. The apparatus of claim 14, wherein the processor is further operative to

derive a correction matrix based on gains of the plurality of transmitter units and gains of the plurality of receiver units, wherein the correction matrix is applied on a transmit path and is used to account for responses of the plurality of transmitter units and responses of the plurality of receiver units.

17. The apparatus of claim 14, wherein the processor is further operative to

derive a correction matrix based on gains of the plurality of transmitter units and gains of the plurality of receiver units, wherein the correction matrix is applied on a receive path and is used to account for responses of the plurality of transmitter units and responses of the plurality of receiver units.

18. A user terminal comprising the apparatus of claim 14.

19. An access point comprising the apparatus of claim 14.

20. An apparatus in a multiple-input multiple-output (MIMO) communication system, comprising:

means for obtaining a plurality of first overall gains for a first receiver unit and a plurality of transmitter units, one first overall gain for each transmitter unit, each first overall gain indicative of a combined response for the first receiver unit and the associated transmitter unit, wherein the first receiver unit is one of a plurality of receiver units;

means for obtaining a plurality of second overall gains for a first transmitter unit and the plurality of receiver units, one second overall gain for each receiver unit, each second overall gain indicative of a combined response for the first transmitter unit and the associated receiver unit, wherein the first transmitter unit is one of the plurality of transmitter units;

means for determining a gain of each of the plurality of transmitter units based on the plurality of first overall gains; and

means for determining a gain of each of the plurality of receiver units based on the plurality of second overall gains.

21. The apparatus of claim 20, further comprising:

means for deriving a first correction matrix based on gains of the plurality of transmitter units, wherein the first correction matrix is used to account for responses of the plurality of transmitter units; and

means for deriving a second correction matrix based on gains of the plurality of receiver units, wherein the second correction matrix is used to account for responses of the plurality of receiver units.

22. The apparatus of claim 20, further comprising:

means for deriving a correction matrix based on gains of the plurality of transmitter units and gains of the plurality of receiver units, wherein the correction matrix is applied on a transmit path and is used to account for responses of the plurality of transmitter units and responses of the plurality of receiver units.

23. The apparatus of claim 20, further comprising:

means for deriving a correction matrix based on gains of the plurality of transmitter units and gains of the plurality of receiver units, wherein the correction matrix is applied on a receive path and is used to account for responses of the plurality of transmitter units and responses of the plurality of receiver units.

24. A method of calibrating transmitter units and receiver units at a wireless entity in a multiple-input multiple-output (MIMO) communication system, comprising:

performing a first calibration to obtain a gain of each of a plurality of transmitter units at the wireless entity and to obtain a gain of each of a plurality of receiver units at the wireless entity, wherein the first calibration is performed based on a plurality of test signals sent via the plurality of transmitter units and received via the plurality of receiver units; and

deriving at least one correction matrix based on gains of the plurality of transmitter units and gains of the plurality of receiver units, wherein the at least one correction matrix is used to account for responses of the plurality of transmitter units and responses of the plurality of receiver units.

25. The method of claim 24, further comprising:

performing a second calibration to determine at least one updated correction matrix for the wireless entity, wherein the second calibration is performed based on a channel response estimate for a downlink and a channel response estimate for an uplink in the MIMO system.

26. The method of claim 24, further comprising:

performing a third calibration to determine errors in the at least one correction matrix, wherein the third calibration is performed based on two different pilots exchanged with the wireless entity; and

updating the at least one correction matrix based on the determined errors in the at least one correction matrix.

27. An apparatus in a multiple-input multiple-output (MIMO) communication system, comprising:

a plurality of transmitter units operative to process a plurality of baseband signals for transmission from a plurality of antennas;

a plurality of receiver units operative to process a plurality of received signals from the plurality of antennas; and

a processor operative to

perform a first calibration to obtain a gain of each of the plurality of transmitter units and to obtain a gain of each of the plurality of receiver units, wherein the first calibration is performed based on a plurality of test signals sent via the plurality of transmitter units and received via the plurality of receiver units, and

derive at least one correction matrix based on gains of the plurality of transmitter units and gains of the plurality of receiver units, wherein the at least one correction matrix is used to account for responses of the plurality of transmitter units and responses of the plurality of receiver units.

28. The apparatus of claim 27, wherein the processor is further operative to

perform a second calibration to determine at least one updated correction matrix, wherein the second calibration is performed based on a channel response estimate for a downlink and a channel response estimate for an uplink in the MIMO system.

29. The apparatus of claim 27, wherein the processor is further operative to

perform a third calibration to determine errors in the at least one correction matrix, wherein the third calibration is performed based on two different pilots received via the plurality of receiver units, and

update the at least one correction matrix based on the determined errors in the at least one correction matrix.

30. An apparatus in a multiple-input multiple-output (MIMO) communication system, comprising:

means for performing a first calibration to obtain a gain of each of a plurality of transmitter units and to obtain a gain of each of a plurality of receiver units, wherein the

first calibration is performed based on a plurality of test signals sent via the plurality of transmitter units and received via the plurality of receiver units; and

means for deriving at least one correction matrix based on gains of the plurality of transmitter units and gains of the plurality of receiver units, wherein the at least one correction matrix is used to account for responses of the plurality of transmitter units and responses of the plurality of receiver units.

31. The apparatus of claim 30, further comprising:

means for performing a second calibration to determine at least one updated correction matrix, wherein the second calibration is performed based on a channel response estimate for a downlink and a channel response estimate for an uplink in the MIMO system.

32. The apparatus of claim 30, further comprising:

means for performing a third calibration to determine errors in the at least one correction matrix, wherein the third calibration is performed based on two different pilots received via the plurality of receiver units; and

means for updating the at least one correction matrix based on the determined errors in the at least one correction matrix.